Mobile phones based agro-advisories role in gender empowerment

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Abstract

Mobile phone-enabled information delivery mechanism has the potential to reduce the knowledge gap between large and small farmers, and also across gender by creating awareness. This paper focuses on how women are receptive to the information that they receive through mobile phones, how the access to information through the mobile phone has helped them to feel empowered? What kind of information they value? And what potentially it means for their empowerment? This is done by analyzing listening behavior of farmers both men and women towards information provided through mobile phones. The study is undertaken in selected villages of two states of India Haryana and Bihar and thus also present some contrasting results across the two states. Female farmers feel that the agro advisories have helped them to increase their knowledge about farming practices which includes information about modern technologies and best practices.

Keywords: India, mobile phones, information, gender empowerment

Jel Codes: Q12 and Q16

1. Introduction

Indian agriculture has suffered from low growth and low productivity in last two decades and this has been attributed to major challenges that include deficits in physical infrastructure, poor availability of agricultural inputs such as seed, fertilizer and agri-related services in rural areas, and farmers' poor access to information about modern technologies and best practices. (Kumar and Rosegrant, 1994; Mittal and Kumar, 2000; Evenson et al., 1999; Fan et al., 1999; Singh, 2002). Several studies recently conducted in South Asia and Africa have shown the potential of modern ICT's (Information and Communication technologies). Mainly mobile phones have the potential to address the issue of existing information asymmetry (Ali and Kumar, 2010; Mittal et.al, 2010; Mittal, 2012; Mittal and Mehar 2013; De Silva et.al, 2010; Muto and Yamano's, 2008; Fafchamps and Minten's, 2011). Mobile-enabled information has the potential to play an important role in improving the adoption of technologies, modern inputs and best practices (Bhatnagar, 2008; Anderson and Feder, 2007). The increasing penetration of mobile networks and handsets and the recent introduction of a number of mobile-enabled information services in rural India presents an opportunity to make useful information more widely available (Fischer et.al. 2009; Mittal, 2012; Mittal and Mehar, 2013)

The overall goals of using the mobile phone-enabled information delivery mechanisms is to enable inclusive growth by reducing the knowledge gap between large and small farmers, and across gender by creating awareness, and also to possess channel of two way communication. Usually the agricultural sector, and in particular farmers, are highly vulnerable to risks due to high variability in climatic conditions and to market uncertainties. The farmer's exposure to risk and uncertainty is often aggravated by lack of information about weather, inputs, farm management practices or market prices, and this lack of information has an adverse impact on crop production and income (Mittal 2012). The expected impact of different types of information is a) an increase in productivity, through informed decision making on crop choice, seed

varieties, inputs, agronomic practices and plant protection b) a reduction in production costs through the adoption of better/quality inputs and technologies, and better management practices and c) improved incomes resulting from reduced costs and better price realization for produce. The process of adoption of mobile telephone based information delivery systems has been slow and many of the models are still at an early stage of development. There are issues relating to the sustainability of these models.

The problem of lack of information is even more pertinent among women engaged directly or indirectly in agriculture. Women farmers' situation is even worse than male farmers' due to less literacy, limited access to assets, cultural barriers and less access to information, which leads to a gender gap (FAO, 2011; Mehar, 2014). Sharma (2009) reports that mobile phone ownership in India is largely limited to the earning male members of the households or the head of the household, although this situation is changing in recent times as mobile phones are largely accessible to women as well. Also the information needs for female farmer can vary widely. While women in Asian countries women are engaged in multiple roles in agriculture in order to support male farmers (family farm) very few are directly working as farmers. Field experience of a study by Tandon (2009) clearly suggests that women are not only keen to get information, they are swift to apply what they learn and are pragmatists when it comes to securing assets, natural resources, capital and markets for the livelihoods of their communities.

Given this background this paper focuses on how women are receptive to the information that they receive through mobile phones and how the access to information through the ICT mode has helped them to feel empowered by information. It is too early to state that this empowerment has been converted into actions whose impact can be quantified, but surely there is evidence where women farmers feel empowered through information and they like to receive the information. This may have also increased active participation of women in the decision making processes at the household level.

Thus this study focuses on how women farmers vis-a-vis the male farmers adopt or accept the information that they receive, what kind of information they value, and what it potentially means for their empowerment which at present is largely measured in terms of behavioral change. This is done by analyzing the trends in the listening behavior of farmers towards information provided through mobile phones. In this analysis we are focusing on the trends of the number of farmers interested in listening to the information and also, their preferences towards certain specific information related to agriculture. Another focus of this analysis is to identify and understand the gender specific preferences for specific information.

2. Conceptual framework

Although some evidence suggests ICTs contribute to general economic growth, there is very little evidence to believe that the poorest countries will be able to utilize its potential fully in increasing efficiencies. The modern means of ICT is still evolving for agriculture sector but it has already started demonstrating its ability to reach the farmers. The effectiveness of the system plays an important role in the magnitude of the impact of an ICT intervention in agriculture. The constraints of institutions and policy can act as binding on the efficient ICT system. Also we expect that as the information gap reduces, the noticeable change in impact will be less. This is so because as farmer becomes more aware the utility of the information they receive declines.

Figure1 illustrates a simplified and generalized framework for socio-economic impact pathways of ICT intervention in agriculture sector. With rise in level of ICT penetration in any cluster or context, after adoption of ICT the immediate impact is realized in form of efficiency in farmers usability of input in an appropriate manner and later impact on farmers profitability evaluated on grounds of increasing yield, reducing production cost and other social benefits. The framework also focus on the concept that like any other normal goods information also has a diminishing marginal utility.

Behavioral change, awareness and information about technology is crucial parameter for technology adoption. Once farmers adopt technologies, with conducive infrastructure and right policy environment later the impacts are evidences to result in major development changes at macro level such as reducing poverty level, food and nutritional security. Such outcomes are always at the heart of design of intervention, but their possibility is related to the success of such intervention via meeting the challenges. The foremost challenge is to make farmers understand, believe and trust the new technologies they are being offered. ICT's play an important role in getting this information and knowledge across to farmers. Overall, it helps in improving the reach, availability and adoption of technology. It creates efficiency in inputs and output markets by bridging the information gap and thus is expected to create efficient innovative institutions and a right policy environment to make the intervention meaningful to create impact.

Under this conceptual framework this paper specifically focuses on two aspects – one utilization of information by women in agriculture and second its usability over time and tests the hypothesis that information utility declines over time. Also the assumption is that if the information is valuable and useful then this utility will not decline.

3. Data and methodology

3.1 The intervention

(M) obile Solutions- is an ICT-based climate and agro services project, as part of the Climate Smart Village model partnered with Kisan Sanchar as disseminating partner and IFFCO Kissan Sanchar limited (IKSL) as the content partner. The aim of this intervention is to improve the adoption of climate-smart agriculture practices like Conservation Agriculture practices (CA), and to increase awareness about climate risk management among farmers. The project aims to document farmers' perceptions on increasingly erratic weather events, rising temperatures and to understand if the information they receive helps in overall behavior change towards adapting to

climate change and the uptake of climate-smart practices. **The project sends voice and text (SMS) messages** in Hindi or a local language to farmers' mobile phones twice a week. Messages include weather forecasts and recommended actions that farmers should take, and information about pests and remedies, seed varieties and climate-smart technologies such as the benefits of conservation agriculture. Additional messages provide information about climate change and its effects on agriculture. The pilot project is designed in a manner that **farmers can call a helpline and ask questions as well. This allows them to get the information they need, and they also contribute towards the content of future messages.**

3.2 Data

The data set used in this paper has been collected during the pilot study of this intervention. Two types of information have been collected and collated to understand the change in perception of farmers with focus on women farmers in the wheat- maize growing cropping systems. The first information is from the electronic listening reports of individual farmers on each of the messages that were transmitted to the farmers under the pilot project where information on different types of messages were sent to them through the voice messages. The second set of data is based on the manual feedback collected from the farmers which aims to quantify the action taken by the farmers on the information received and to assess the potential perceived benefits.

This data set is based on the households in the villages of Karnal district of Haryana and Vaishali district of Bihar. Villages covered are: Anjanthali, Garhijattan, Sawant, Sandhir in Karnal district of Haryana and Dabaich, Laksminarayanpur, Mukundpur, Rajapakar in Vaishali district of Bihar. This data set represents the period 1st September 2013 to 31st May 2014 during which farmers have listened to the information provided through voice messages. The total number of farmers under the project was 1,100. Of these randomly 510 were asked to give feedback of its usability and effectiveness. The feedback information is based on data collected between November 2013 and January 2014. In this study women are either the head of the household or they are female

member in male headed households. Since they are receiving information on their mobile phone independently, the purpose is also to create awareness and their understanding of modern technologies, so that they can be empowered to take active participation in the household decision making processes related to agriculture. 58% of the sample farm households cultivate maize mainly concentrated in Vaishali district, with very few maize growing household found in Karnal district.

The methodology followed in this study consist of collection and analysis of listening data for each message by every farmer. Average listening rate is the average time (in seconds) the farmer has listened to a message. All this information is electronically recorded. The average listening rate is used as an indicator in this analysis because it measures the time duration for which the farmers are listening to the message, although they have an option of disconnecting the phone. Thus it is taken as an indicator of their interest in the information they are receiving. It is assumed that if eth farmer chooses to listen to a type of information or to longer duration of the information then they are getting valuable information or are interested to know about the information that is being disseminated.

Based on this we analyzed the trend by types of messages, and monthly data across gender to understand the listening behavior of the farmers. The data is analyzed for the mean duration of listening to each message. Around 345 messages have been disseminated during the period under study. The messages length range between 45 seconds to 90 seconds and the average message duration for all the messages is 58 seconds. The electronic generated data set is supported by the feedback survey to understand which information are valued highest by farmers, the action taken on the messages received/ listened by farmers and the perceived benefits of the messages. The questionnaire was prepared according to the type of voice messages that was being sent to the farmers including information on: weather, seed and related seeding practices, insect and pest management, livestock, CA technologies and other farming and agriculture related information

to determine farmers' preferences regarding the types of messages and to identify the type of messages that was beneficial to them, and to derive with suggestions to improve the message services. Both open ended and closed-ended questions were formulated to reveal necessary information from the farmers.

For the analysis of the data set, the responses to closed-ended questions were analyzed by using a simple statistical method to determine the average responses to any particular question. The responses to the open ended question were grouped and coded and then simple statistical methods were used to extract the descriptive statistics to determine the preferred type of messages by the farmers, why they are preferred and how they have proven to be beneficial. In the feedback survey 5.1 and 13.3 percent of the respondents were women in Karnal and in Vaishali respectively. While in the electronic survey 8.1% and 18.2% of the respondents are women from Karnal and 18.2 % from Vaishali.

4. Results and discussion

4.1 Data description

The average age of the farmers in the sample households is 41.9 years. The average age of farmers from the district of Karnal is 41.7 years and for Vaishali it is 42 years. The average age of women in the surveyed households is 36 years. Among the eight villages under study, there is no women participation from Sawant village in Karnal and in the other villages of Karnal about 7% of female farmers have responded to the feedback survey. On the other hand, the response rate of female farmers from the villages in Vaishali is comparatively higher than that of Karnal in Haryana. The percentage of female farmers that have responded is around 16% out of the total responses. Rice and wheat are the major crops grown by the studied households. Out of 510 households surveyed, 258 produced maize. In Haryana only 10.8% of the analyzed households cultivate maize whereas the respective figure for Bihar is around 89.5%.

In Haryana, it can be observed that 55.3 percent of the farmers share their messages only when they feel it is required. 21.6 percent of the farmers prefer to share messages weekly and 11.4 percent daily. About 4.7% of the farmers prefer not to share their messages. In Bihar, it is seen that most of the farmers prefer to share their messages weekly, which is the case for 43.7 percent of the farmers. The cumulative effect of information is that all the farmers under the study also share the information with other farmers in their network which leads to indirect dissemination of information. 42.4 percent of the male farmers and 69.2 percent of the female farmers share the messages within their network on a weekly basis. 70.6 percent of the males responded that they also share this information with the females in the family. All the females' said that they share it with other women in the community who don't received this information.

4.2. Gender wise listening rate at state and village level

Women access to knowledge and information is very limited as some believe is that they don't need it, but Munyna, (2000) has shown that if the women are not fully informed about the technologies, market information and other agriculture related aspects then it impacts the overall agricultural development.

Thus while tracking the message listening rate[1] it is interesting to note that the female farmers, who were listening to the messages, on average, listen to the messages as long as the male farmers were doing on average (fig 2). This can be taken as the first indication, that they found the information useful or that they were interested to listen to the information as much as their male counterparts. This is further investigated through survey based questionnaire where 98.6

[1] Mean duration of message is described as the mean of the total duration of different messages listened by the farmer over time.

percent of the women said that they find the information useful. Another observation is that the difference in the listening duration between male and female farmers is smaller for Vaishali as compared to Karnal, but overall the difference is marginal only.

Even at the village level (fig 3), on comparing the male and female listening rate, it is interesting to note that, the trend are similar to that at average state level. The only major exception is one village Sawant in Karnal where there is no female participation. In other three villages in Karnal, the difference between male and female listening behavior is not very different.

In Vaishali district the villages like Dabaich and Mukundpur have high mean duration of message listened by female farmers than male farmers. It can be said from the above results that villages which has female participation in both the districts show similar trend among male and female farmers. This shows that female farmers are listening to the agro- related information and it has successfully penetrated among the female farmers.

4.3. Message listening rate by type of information

To look at this further we want to understand the listening pattern for types of information that the farmers/ listeners prioritize. From the feedback survey we got data on which information the farmers valued the most. Table 1 presents the details of information that farmers valued the most. Figure 4presents the actual listening rates of information. There are some difference in farmer's perceptions as presented in table 1 and results in figure 4. E.g. Information on conservation agriculture and post-harvest management were not put in priority list by farmers, but the listening rate to these information is high across both the districts.

Weather information has been of most relevance to all the farmers, male and female, in both the districts. Followed by information on nutrient management and seeds. Both male and female

farmers in Vaishali district along with few male farmers in Karnal valued pest management information. Farmers responded that right weather forecast helps them to plan for their irrigation and input use and thus it's of most importance for them. Farmers in Vaishali feel that they face maximum losses in their wheat and maize crop due to pest infestation and thus for them information on pest management is very important to save crop from losses. More farmers in Vaishali are engaged in maize production as compared to farmers in Haryana and thus for them information on post-harvest management of maize is also important. It is interesting to see that females in Vaishali have not listed post-harvest management information as important for them.

When we compare these trends with the general trends in listening to messages, it is interesting to see that when farmers were exposed to information which they did not specify as being important to them, they were interested to listen to that information to the same magnitude as they were listening to the information that they had assigned a priority to (Figure 4). The mean duration in seconds of listening to a message on seed information of women farmers in both the districts is as high as that of male farmers although it was not of high importance for them as indicated during the questionnaire based feedback survey. Similarly duration of listening to the information on post-harvest management techniques of farmers in Karnal farmers is very similar to that of farmers in Vaishali.

Figure 4 again highlights that women farmers' interest in getting information in both of the districts is very similar to that of the male farmers. In Karnal district, the highest mean durations of message listened by female farmers are related to nutrient management (48 seconds) and CA technologies (40 seconds) although women are usually not directly involved in both of these aspects and these aspects are largely taken care of by male members of the family. There is no such big difference found in male and female listening behavior in most of the other categories; indicating that the preferences of male and female farmers towards specific information are rather similar. However there are some categories in which a difference is observed. Information

related to post –harvest management and CA technologies have a higher mean of the duration of listening to a message for male farmers than for female farmers, indicating differences in preferences of male and female farmers towards such information (Fig. 4).

In case of Vaishali also the highest mean of the duration of message listened by female farmers are related to post-harvest management and CA technologies. The lowest mean duration of message listened by female farmers is observed in information related to livestock (38 seconds). Under the assumption that livestock activities are primarily taken care by the females, this would indicate that women don't find much utility in the information about livestock as they might perceive to possess sufficient knowledge about livestock keeping due to their experience. This also raises the question, if the utility of information declines with pre knowledge of the information, with continuous flow of information or if the content of the message is not relevant.

This analysis is also indicative of that farmers might not be able to priorities the information which they are not aware of and thus when they are exposed to a new information about technology or inputs, they are interested to know about it. This acts as the enabling condition to adopt these new technologies. This also signified that fact that both demand and supply driven information services are important.

4.4. Message listening rate over time

To test the assumption that information utility declines over time, we analyze the monthly trends to see if there are diminishing returns to the information received by the farmers and if this can also be found across gender. Information and its demand are very dynamic and there is a diminishing return to the utility of information as well, like for other normal goods (Mittal, 2012). The month wise trends are presented in Figure 5 for Karnal and Vaishali district respectively.

It can be interpreted from the graph that in Karnal, mean duration of message listened to by the female farmers shows a positive trend. Similarly, the mean percentage of total messages listened to by female farmers is also increasing over time. It means that female farmers were responding well to the messages and their interest in mobile based information is even increasing as time progresses. While over time the mean listening rate for male's declines a bit over time. Accordingly the following interpretation could be made: although our assumption of declining marginal utility holds true for men it does not hold true for women. This can also be interpreted that quite likely there was a large information asymmetry among female farmers in Karnal and therefore their interest in mobile based information increased over time while that of men didn't.

The trends in Vaishali are different from the trends in Karnal. Initially mean duration of message listened to by female farmers is increasing till January 2014 and afterwards it started decreasing making it an inverted 'U'graph as described in Mittal (2012) and also in the conceptual framework. It may be concluded that female farmers in Vaishali initially showed interest in agro-related information, but as they are actively involved in agriculture and have experience in farming the information had less utility for them over time. This also indicates that the information gap of women farmers in Vaishali is comparatively smaller than the information gap of female farmers in Karnal. These results need to be further validated using more information category wise details to see the trends as per the messages.

4.5 Action taken on the messages

In the above sections we have analyzed what information female and male farmer's get and accordingly assessed their information needs and behavior towards those information. Based on the feedback surveys we have interacted with a sample of these households through a structured questionnaire and also through focus group discussions to understand which actions, if any, were taken by these farmers. After they were given more precise information about 92.9 percent of

male farmers from Karnal and 77.3 percent of male farmers from Vaishali reported to have taken action. In Haryana although the women listening rate is quite good they have limited ability to take action due to their low involvement in agriculture. But for them, information is power and it's their right. (Ref to a female farmer of Anjanthali, Haryana quoted). In Bihar 83.3 % of female farmers with whom the feedback surveys were done and were engaged in maize farming reported to have taken action on the information they received.

"I have the right to know." 23-year-old female farmer from Anjanthali
The most useful of the information to me has been on rainfall forecasts. I come from an agriculture family and I know how important weather and climate-related information is to be able to have a good yield. In the past I did not think there was so much thought and understanding in agriculture. When I listen to the messages now I realize how every small detail can help a farmer. I often discuss this with my husband. Even though I don't do any agriculture work myself on the fields- apart from sometimes tending to the livestock, I believe I have the right to know as we manage the family farm and I can see my husband use new techniques and climate-smart practices.

The cost of attaining information is usually very high for female farmers (Lastarria-Cornhiel, 2008). In such a scenario providing agro-related information through mobile calling can be beneficial for female farmers as it will significantly reduce the cost of information for the female and also with proper information productivity will increase and this will be reflect in increasing profits. Female farmers are also listening to the agro- related information and it shows the potential of ICT in providing information among the female farmers and in long term empowering them with information. Therefore, ICT can be a tool for the empowerment of women engaged in agriculture.

Overall in the study region the most prominent actions that farmers reported taking after they got connected with the information agro advisories delivered through CCAFS are as given in Table 2. Not all actions were taken by women, because of their limited direct involvement, but actions where female farmers responded that they took action were on the information they received about nutrient, weed, and pest management. This information was new to them and they found it valuable to apply to benefit from in in their agricultural activity.

The perceived benefits that farmers thought they would attain by taking action on agro advisories are presented in Table 3. It is interesting to note that in 7-8 months of information and agro advisories received, which these male and female farmers were not receiving earlier, they have realized its importance and might in future be able to convert the information into benefits. 70 percent of the female farmers feel that the agro advisories have helped them to increase their knowledge about farming practices which includes information about modern technologies and best practices. They feel that by using this information they can experience better yield for their crops. 48.1 percent of the female farmers felt that it will help them to reduce cost and inputs with efficient management and utilization of inputs, although they are still skeptical if input use efficiency will really be achieved. 55.6 percent of the female respondents think it will help them to reduce losses. The most valued information for them is about weather forecast which will enable them to take informed decisions. The cited example was that information about unusual erratic and excess rainfall in Rabi season of 2013-14 which helped them to save the number of irrigations and also the wheat crop. Pre-information on the likelihood of bad monsoon in western India helped them to diversify their cropping system towards maize or to use technological diversification towards DSR technology. More detailed investigation and appropriate impact assessment studies are required to firm up these initial evidences.

5. Conclusion and way forward

The study suggests that information delivered through mobile phones help in reducing the information gap among farmers and have the potential to enhance productivity. Realizing the full potential of this approach, however, will require significant improvements in the supporting infrastructure and also in capacity building, particularly for small farmers, to enable them to use the information they access more effectively. Farmer groups have become more aware about these technologies and also value the information on weather delivered to them. Women farmers have valued these services, show interest in knowing about these technologies, and feel empowered with information. They also have become more aware about climate smart technologies. It's still a long way to convert this information into action in parts of the country where direct involvement of women in agriculture is limited. But the women in the male headed households also feel that their participation in family agriculture has improved with increased information flows. Farmers have been able to quantify how precise and timely weather based agro-advisories have helped them to take informed decisions about the use of inputs during the sowing season based on which they have saved on irrigation and also on the costs of pesticides and herbicides based on the information received. Overall the average of women farmers' listening rate to messages received through voice calls is as good as that of male counterparts. The feedback forms collected from women farmers often report that the information they listen to on their mobile phones has helped to increase their knowledge about the climate smart technologies and the efficient use of inputs through their participation in decision making that made them sensitive towards climate change.

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Fig 1: Framework for Socio-Economic Impact of ICT in Agriculture sector

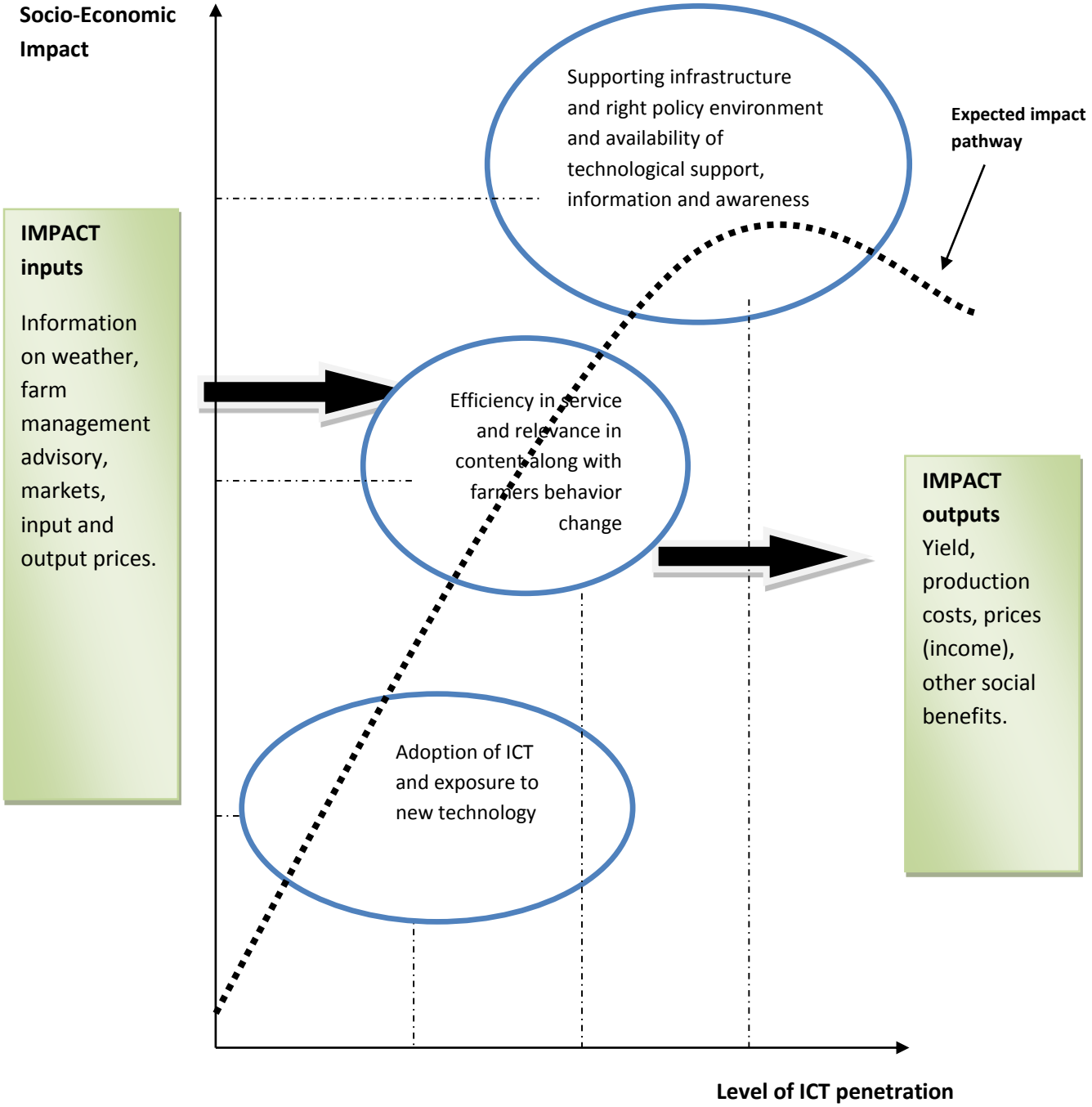


Fig 2: Gender wise mean duration of message listened by farmers in both districts

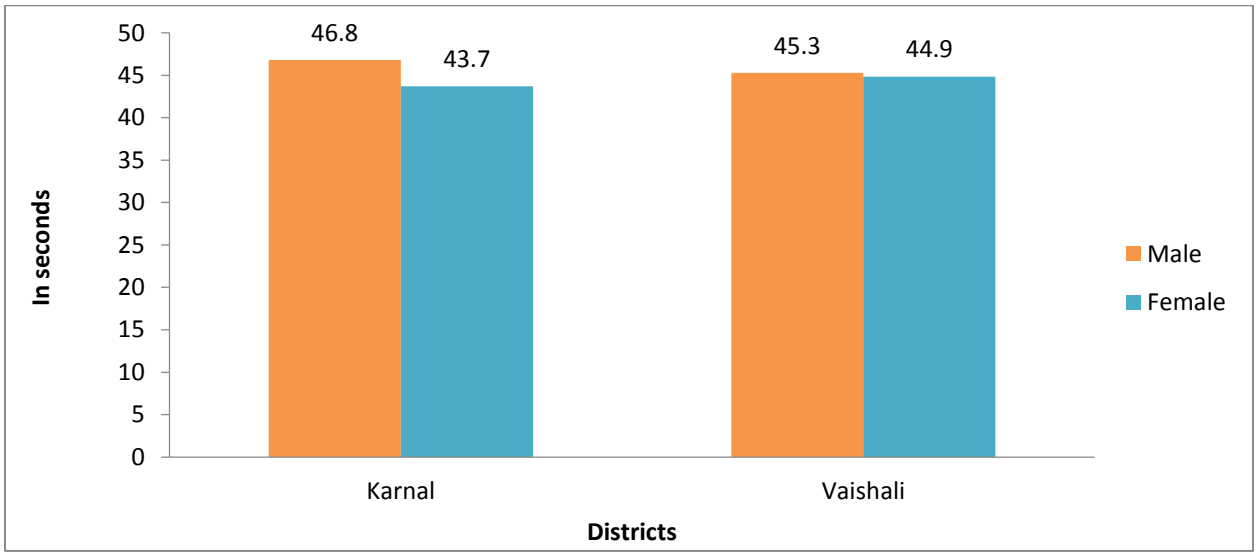
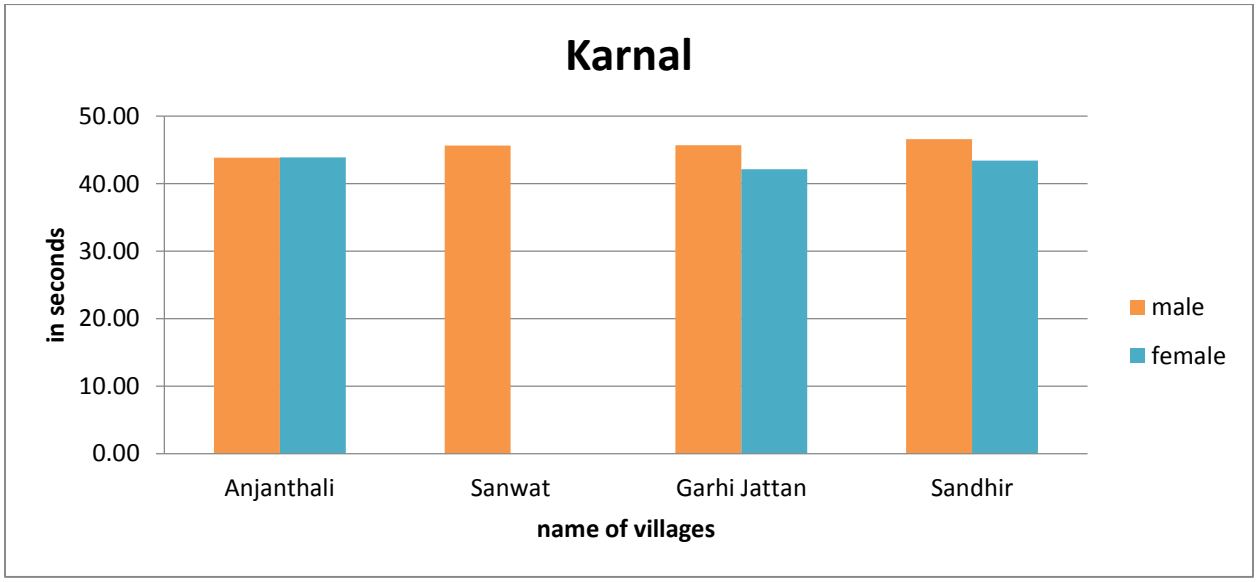


Fig 3: Gender wise mean duration of message listened by farmers by villages.



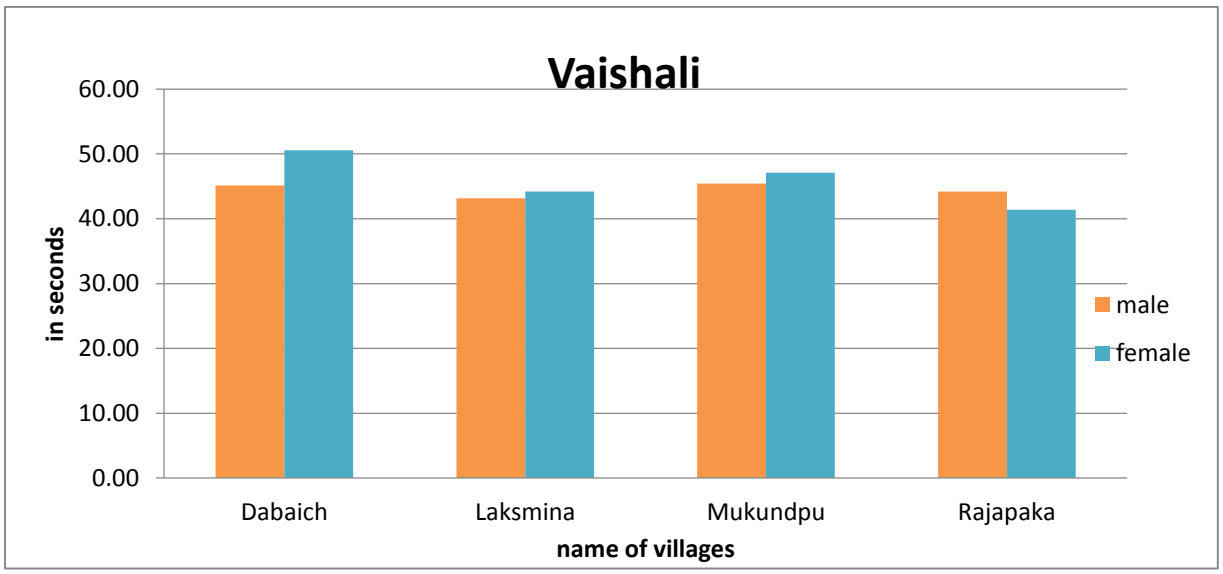


Fig 4: Gender wise mean duration of message in different types of information listened by farmers

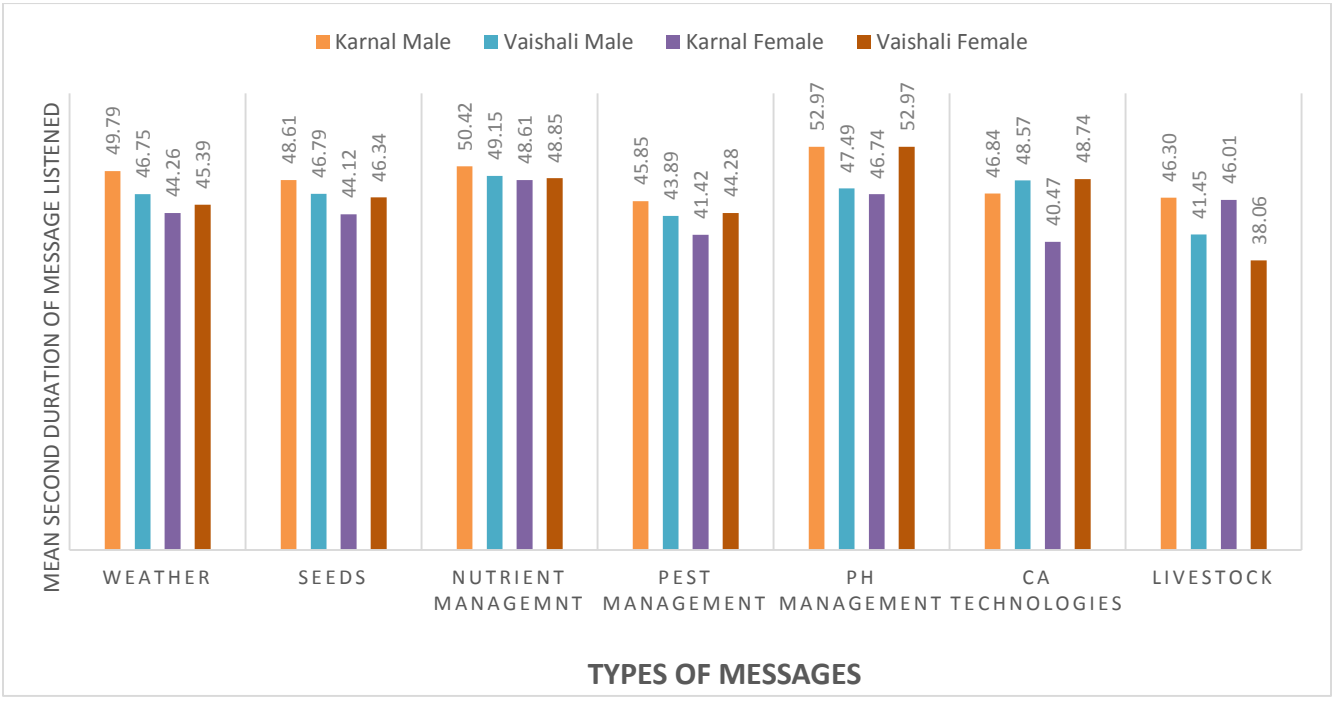
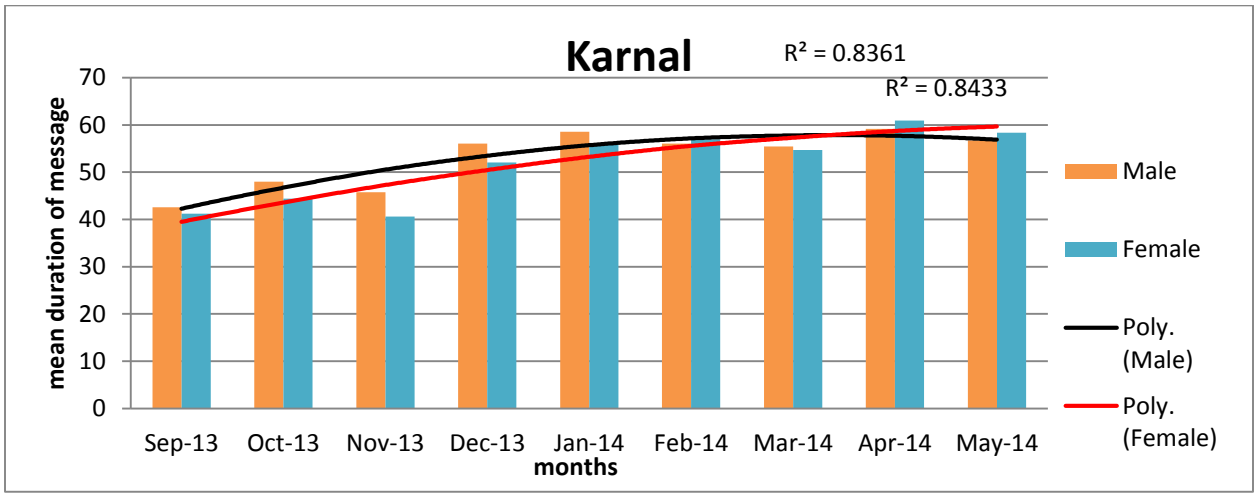


Fig 5: Gender wise mean duration of message listened across different months



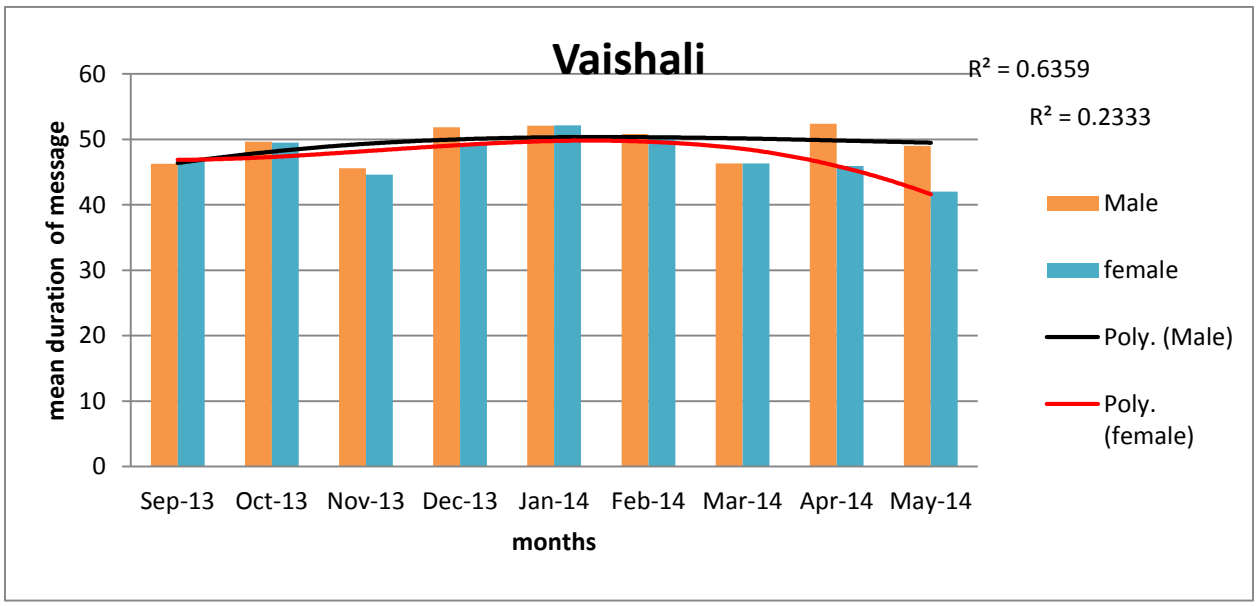


Table 1: The information that the farmers valued the most (in percent)

Type of information	Karnal Male	Vaishali Male	Karnal Female	Vaishali Female
Weather	64.3	50.0	95.8	38.5
Seeds	10.7	9.3		
Nutrient management	14.3	0.5		
Pest management	3.6	20.2		30.8
PH management		15.5		
CA technologies	3.6		4.2	
Livestock	3.6			

Note: Blanks indicate these information didn't fall in their priority list

Table 2: The most prominent actions reported by farmers after receiving messages

Action taken	Male	Female	remarks
Weather information utilized to plan irrigation and input use	yes	No	
Land preparation with new technologies like zero tillage	yes	no	Only in Vaishali
Using recommended varieties of seed (varietal diversification)	yes	no	
Nutrient management	yes	yes	Only in Karnal
Weed management	yes	yes	Only in Vaishali
Pest management	yes	yes	Most important inf. taken
Conservation agriculture	yes	no	Only in Karnal

Table 3: The perceived benefits by farmers with increased access to reliable and timely information

	As responded by % of farmers	
Perceived benefits	**Male**	**Female**
Know more about farming practices	79.7	70.4
Experienced better yields	63.6	70.4
Reduced cost on inputs	64.1	48.1
More aware about the right input use	49.4	29.6
More aware about technologies	50.6	51.9
Has helped to reduce loss	72.7	55.6
Better weather information for action	76.2	77.8